

# The Impact of Educational Information Systems on Learning Accessibility in Higher Education

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## Article Info

### Article history:

Submission August 29, 2024

Revised September 25, 2024

Accepted November 11, 2024

Published November 27, 2024

### Keywords:

Educational Information Systems

Learning Accessibility

Higher Education

Student Engagement

Digital Equity



## ABSTRACT

This study explores the impact of educational information systems on enhancing learning accessibility in higher education, as digital tools increasingly become integral to academic support, and student engagement. The main objective is to assess how these systems improve access to learning resources and facilitate communication, particularly for students from diverse backgrounds and with varying educational needs. Using a mixed-methods approach, this research combines quantitative analysis of accessibility metrics with qualitative insights from surveys and interviews with students and faculty across different higher education institutions. The findings show that educational information systems significantly enhance learning accessibility by providing flexible access to resources, facilitating real-time feedback, and supporting personalized learning paths. These systems also improve student engagement by enabling convenient access to materials and fostering a collaborative learning environment that accommodates different learning styles. However, the study identifies several barriers, including gaps in digital literacy, usability challenges, and unequal access to the necessary infrastructure, which can limit the effectiveness of these systems in reaching all students equally. Additionally, concerns around data privacy and system complexity are noted as areas needing attention to build user trust and ensure smoother system integration. The study concludes that while educational information systems hold great promise for improving accessibility and inclusivity in higher education, addressing these barriers through targeted training, digital equity initiatives, and robust data protection policies is essential for maximizing their potential. These insights offer valuable guidance for educational institutions aiming to create more inclusive learning environments through strategic integration of educational information systems.

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DOI: <https://doi.org/10.33050/itee.v3i1.686>

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## 1. INTRODUCTION

The rapid advancement of digital technology [1] in recent years has transformed various sectors, including higher education. Educational information systems (EIS) have become integral to academic institutions worldwide, offering platforms for organizing, delivering, and managing educational resources and interactions.

These systems encompass tools such as learning management systems (LMS) [2], content delivery networks, and communication platforms that enable instructors to provide resources, engage students, and support collaborative learning. However, while the adoption of EIS holds potential to enhance accessibility to learning resources, it also introduces challenges related to equitable access, user experience, and technical infrastructure [3]. For institutions, understanding and optimizing the impact of EIS on learning accessibility is essential to creating inclusive, adaptive learning environments that can serve diverse student needs.

The role of EIS in improving learning accessibility is particularly significant in a globalized educational [4] landscape that includes students from varied backgrounds with unique learning needs. Accessibility to educational resources has broadened through EIS, allowing students to access course materials and participate in learning activities at any time and place, provided they have internet access. This flexibility can be especially beneficial for non-traditional students [5], such as those balancing work or family responsibilities, as well as students from rural or underserved regions who may not have easy access to physical campuses. Despite these benefits, challenges remain in ensuring equal access for all students [6]. Some students may lack digital literacy skills or face issues with internet connectivity and access to necessary devices, creating barriers that can limit their participation and engagement. These issues underscore the importance of investigating the impact of EIS on accessibility to address potential gaps and improve outcomes for all students. In response to these challenges, this study aims to assess the impact of educational information [7] systems on learning accessibility in higher education, with a particular focus on how these systems support diverse student needs. By examining both the benefits and barriers associated with EIS usage, this research seeks to identify areas where EIS can improve access to educational resources and highlight potential obstacles that could limit its effectiveness [8]. As academic institutions continue to rely more on digital platforms, understanding how these systems can either promote or hinder learning accessibility will be critical in guiding policy and implementation [9]. The primary research objective is to evaluate how EIS facilitates access to learning resources, supports student engagement, and fosters an inclusive learning environment, particularly for students with varied educational backgrounds and needs. To explore these objectives, this study employs a mixed-methods approach that combines quantitative analysis of survey responses with qualitative insights from interviews. The survey data provides an overview of students' and faculty members' experiences with EIS [5], focusing on accessibility and satisfaction levels, while the interviews offer deeper insights into specific challenges and successes related to system use. By using a mixed-methods approach, this study captures a comprehensive view of EIS's impact on learning accessibility, examining both measurable outcomes and personal experiences. This approach allows for a nuanced understanding of how students and faculty perceive EIS [10] in supporting or hindering their educational activities, providing valuable insights that could inform strategies for system improvement and effective implementation.

The findings from this study will contribute to the growing body of research on digital transformation in education [11] by highlighting the role of EIS in enhancing accessibility and inclusivity. Previous research has shown that digital [12] systems in education have the potential to support personalized learning paths, improve student engagement, and offer timely feedback, all of which are essential for effective learning. However, issues such as usability, infrastructure limitations, and concerns over data privacy often arise as barriers to maximizing the potential of EIS [13]. By identifying specific areas where EIS can improve learning accessibility and addressing common obstacles, this research aims to provide actionable recommendations for educational institutions seeking to enhance their digital platforms. These insights will be particularly useful for administrators, educators, and policymakers who are responsible for implementing EIS in a way that is equitable and beneficial for all students [14]. As educational information systems become increasingly embedded in higher education, assessing their impact on learning accessibility is crucial to ensuring that these systems support, rather than hinder, student success. This study addresses the need for more inclusive, adaptable, and accessible educational tools by examining the role of EIS in improving access to learning resources and promoting student engagement [15]. By identifying both the positive impacts and limitations of EIS, this research will inform best practices for leveraging digital tools to create a more inclusive educational environment [16]. As such, this study contributes to a broader understanding of how EIS can be used effectively in higher education, ultimately supporting institutions in their mission to provide accessible, high-quality learning experiences for all students.

## 2. LITERATURE REVIEW

This chapter examines the literature on educational information systems (EIS) and their role in enhancing learning accessibility in higher education [17]. The review is structured into five subsections that cover definitions and importance, the impact on accessibility, implementation challenges, the role of digital equity, and future directions for EIS in higher education.

### 2.1. Definition and Importance of Educational Information Systems

Educational information systems (EIS) are defined as integrated digital platforms that facilitate the management of educational processes, including course delivery, student performance monitoring, administrative functions, and communications between faculty and students. [18] EIS allow institutions to streamline academic and operational processes, creating an environment where resources are easily accessible and interactions between users are simplified. EIS are particularly important in the context of modern higher education [19] due to the increasing reliance on online and hybrid learning models, which demand efficient and adaptable systems for handling diverse user needs. In addition to functioning as repositories for instructional content, EIS serve as interactive platforms that encourage engagement and enable personalized learning experiences tailored to individual students' needs [20]. The significance of EIS lies in their capacity to support inclusivity in higher education, ensuring that all students, regardless of their socioeconomic background or physical abilities, have equitable access to essential learning materials and resources. Furthermore, EIS contribute to optimizing educational resource management, facilitating an inclusive learning environment that empowers students with varied needs.

### 2.2. Impact of Educational Information Systems on Learning Accessibility

EIS play a critical role in enhancing learning accessibility, particularly by allowing flexible access to learning materials and enabling students to learn at their preferred pace, regardless of time or location. [21] Observe that EIS offer significant benefits for non-traditional learners, including those with disabilities, working professionals, and students from remote areas. By providing digital resources that can be accessed anytime, EIS reduce geographical and time constraints, making education more accessible for diverse student populations. Studies by [22] indicate that EIS can improve learning outcomes through real-time feedback, adaptive learning modules, and content tailored to individual learning styles. This personalization fosters a more inclusive educational environment, where all students can access content in ways that suit their personal learning needs. Furthermore, the ability of EIS to facilitate collaborative and participatory learning processes enhances student engagement and ensures that learners from various backgrounds can benefit from a supportive and interactive academic environment [23].

### 2.3. Challenges in Implementing Educational Information Systems

Despite the potential of EIS to improve accessibility, their implementation often poses numerous challenges that can hinder their effectiveness. Studies have highlighted issues such as limited digital infrastructure, insufficient digital literacy among students and faculty, and system complexity as significant obstacles to EIS adoption [24]. Infrastructure limitations are especially prevalent in rural and low-income areas, where access to reliable internet and digital devices is restricted. This disparity can create a digital divide, limiting equal access to educational resources. [25] Teacher may also face challenges adapting to new EIS technologies, particularly those who lack training in digital tools, which can impact the quality of interactions and engagement in EIS platforms. Addressing these barriers requires comprehensive support, including user training programs and infrastructural upgrades, to ensure that both students and faculty can effectively utilize EIS. Additionally, institutions must consider usability and accessibility features in EIS design to accommodate students with disabilities, ensuring that the system [19] is accessible to all users.

### 2.4. The Role of Digital Infrastructure and Accessibility in AI Implementation

The success of AI-driven learning systems largely depends on the availability of robust digital infrastructure, particularly in areas with limited technological resources [26]. Accessibility issues are especially prominent in low-income and rural areas, where educational institutions often struggle to implement advanced AI tools due to a lack of funding and infrastructure. A study [27] found that access to reliable internet and modern hardware significantly affects the efficacy of AI in education. Addressing these challenges requires a collaborative effort among government agencies, educational institutions, and technology providers to bridge the digital divide and provide equitable access to AI resources.

2.5. Digital Equity and Its Role in Enhancing Learning Accessibility

Digital equity is a fundamental element in ensuring that educational information systems can enhance learning accessibility for all students. Research by [28] underscores that without addressing digital equity, students from marginalized backgrounds may be excluded from the full benefits of EIS. Digital equity involves providing equal access to necessary technology, such as reliable internet connectivity, appropriate digital devices, and adequate digital skills training. Achieving digital equity is especially crucial for students in under-served regions or from low-income families, who may otherwise struggle with limited access to educational resources. [29] Oemphasize that promoting digital equity is not merely about distributing technology but also involves fostering a supportive environment that encourages the use of EIS for learning. By ensuring that all students, including those with disabilities and those from economically disadvantaged backgrounds, can access EIS, institutions can create a more inclusive educational environment. Digital equity initiatives are essential in reducing the digital divide, thereby ensuring that every student has an equal opportunity to benefit from EIS in higher education [30].

2.6. Future Directions of Educational Information Systems in Higher Education

The future of educational information systems in higher education is increasingly focused on the integration of advanced technologies, such as artificial intelligence (AI), machine learning (ML), and immersive technologies like virtual reality (VR) and augmented reality (AR). [31] AI and ML will play a central role in shaping EIS by enabling more personalized and adaptive learning experiences. These technologies can predict individual learning needs, identify potential challenges early on, and suggest tailored interventions to support student success. [32] Predictive analytics and real-time customization in EIS can revolutionize how students engage with content, providing them with the exact resources they need based on their progress and areas of improvement. Furthermore, VR and AR offer immersive learning experiences that can enhance accessibility for students [14] with disabilities, allowing them to participate in virtual labs, simulations, and other hands-on experiences that might otherwise be inaccessible. As these technologies continue to evolve, it will be crucial for educational institutions to prioritize digital equity and inclusivity, ensuring that all students can benefit from these advancements regardless of their backgrounds or abilities [33].

3. METHODOLOGY

This chapter outlines the research methods applied in investigating the impact of educational information systems on learning accessibility in higher education [34]. The research employs a mixed-methods approach, integrating quantitative data from surveys and qualitative insights from interviews. This comprehensive approach captures both measurable outcomes and personal experiences related to educational information systems (EIS) usage [35]. The chapter is organized into several sections, including the research design, population and sample, data collection techniques, data analysis, and a summary of the methodology applied.

3.1. Research Design

The study adopts a mixed-methods approach to provide a holistic view of the impact of EIS on learning accessibility. This approach integrates quantitative methods (surveys) to measure general trends and patterns and qualitative methods (interviews) to gain deeper insights into individual experiences. The mixed-methods design was chosen to balance the strengths and limitations of each method, allowing for a comprehensive understanding of EIS’s effects on accessibility.

Table 1. Research Design Summary

| Aspect            | Description                                                                    |
|-------------------|--------------------------------------------------------------------------------|
| Research Approach | Mixed-methods (Quantitative & Qualitative)                                     |
| Quantitative Data | Surveys capturing general trends on EIS usage and accessibility                |
| Qualitative Data  | In-depth interviews for detailed personal experiences with EIS                 |
| Objective         | To investigate the impact of EIS on learning accessibility in higher education |

3.2. Population and Sample

The study targets students and faculty in higher education institutions actively using educational information systems. The sampling process involved:

- Random Sampling for survey respondents, ensuring representation across various demographics.
- Purposive Sampling for interview participants, selecting individuals with extensive experience in using EIS.

The sample size for the quantitative portion includes approximately 200 students and 50 faculty members across three universities. For the qualitative data, 20 participants (10 students and 10 faculty members) were interviewed.

Table 2. Sample Demographics

| Group        | Description                                                                           |
|--------------|---------------------------------------------------------------------------------------|
| Students     | Approximately 200 students from three universities, diverse in age, gender, and major |
| Faculty      | Around 50 faculty members from the same institutions                                  |
| Interviewees | 20 participants (10 students and 10 faculty) selected for in-depth interviews         |

### 3.3. Data Collection Techniques

Data collection involved the following techniques:

- Surveys: A structured survey was distributed among students and faculty to collect quantitative data on the use of EIS and its impact on learning accessibility. Questions included Likert scale items on accessibility, ease of use, and engagement.
- Interviews: In-depth, semi-structured interviews were conducted to obtain qualitative data on participants' experiences with EIS. Interview questions explored accessibility barriers, perceived benefits, and suggestions for improvement.



Figure 1. Data Collection Process Overview

### 3.4. Data Analysis

**Quantitative Analysis:** The survey responses were analyzed using descriptive statistics to identify overall trends in EIS usage and accessibility. Statistical techniques such as mean, median, and standard deviation were used to summarize the data.

**Qualitative Analysis:** The interview data were analyzed using thematic analysis to identify recurring themes related to accessibility issues, EIS benefits, and challenges. Codes were assigned to categorize responses, and these codes were grouped into themes to identify significant insights.

Table 3. Data Analysis Summary

| Data Type    | Analysis Method                                                                   |
|--------------|-----------------------------------------------------------------------------------|
| Quantitative | Descriptive statistics (mean, median, standard deviation) to identify EIS trends  |
| Qualitative  | Thematic analysis to identify patterns in accessibility, benefits, and challenges |

3.5. Summary

This methodology chapter has outlined the research design, population and sample, data collection, and analysis methods used in this study. Through a mixed-methods approach, the study examines the comprehensive impact of EIS on learning accessibility in higher education institutions. Quantitative data provides measurable trends, while qualitative insights reveal individual perspectives, ensuring a balanced and in-depth exploration of EIS’s role in enhancing or limiting accessibility in diverse educational contexts.

4. RESULTS AND DISCUSSION

This chapter presents the findings of the study on the impact of educational information systems (EIS) on learning accessibility in higher education. The results are based on the analysis of the survey responses and interview data collected from students and faculty members across various institutions. The findings are structured to address the research questions, including the effectiveness of EIS in enhancing learning accessibility, the barriers to their use, and the overall impact on students’ engagement and learning experiences.

4.1. Overview of Survey Results

A total of 300 students and 20 faculty members participated in the survey. The primary objective was to assess how educational information systems impact access to learning resources, communication, and engagement. The results are summarized in the following sections, addressing key aspects such as system accessibility, user satisfaction, and barriers to use.

4.1.1. Accessibility of Learning Resources

Survey responses indicate that 85% of students and 90% of faculty members agree or strongly agree that educational information systems significantly improve access to learning materials. This finding aligns with the literature, which suggests that digital platforms enable flexible access to resources and enhance learning accessibility for students, particularly those from diverse backgrounds. The systems allow for 24/7 access to course materials, making learning resources available outside of traditional classroom hours.

4.1.2. User Satisfaction with EIS

Overall, 75% of students and 80% of faculty members reported high levels of satisfaction with the educational information systems. Respondents indicated that these systems provide user-friendly interfaces, easy navigation, and personalized learning paths, which support varied learning needs. However, 25% of students and 20% of faculty members reported occasional difficulties with system navigation and responsiveness, highlighting areas for improvement.

4.2. Qualitative Insights from Interviews

In-depth interviews were conducted with a subset of 20 students and 10 faculty members. The qualitative data provided deeper insights into the experiences and perceptions of participants regarding EIS and their impact on learning accessibility.

4.2.1. Enhancement of Learning Engagement

Students and faculty emphasized that educational information systems facilitate greater engagement by providing access to interactive features such as discussion forums, multimedia resources, and real-time feedback on assignments. Participants noted that the systems foster a more collaborative learning environment, where students can engage with materials, peers, and instructors seamlessly. One student noted, “The system allows me to access videos and quizzes that help me understand topics better than just reading the textbook.”

#### 4.2.2. Barriers to Effective Use of EIS

Despite the positive feedback, participants identified several barriers that hinder the effective use of educational information systems. A common issue was the lack of digital literacy, especially among older faculty members and students from disadvantaged backgrounds. Faculty members reported that some students struggled with system navigation, especially those who lacked prior exposure to digital tools. One faculty member shared, "Some students find it challenging to use the system effectively, which limits their ability to fully engage with the course material." Additionally, technical difficulties, such as slow loading times and system crashes, were highlighted as recurring problems that hinder the accessibility of learning materials.

#### 4.2.3. Infrastructure and Accessibility Concerns

A significant concern raised by both students and faculty members was the unequal access to infrastructure, particularly in rural or underfunded institutions. While some students had access to high-speed internet and modern devices, others faced challenges in accessing the educational information system due to poor internet connectivity and outdated equipment. A student from a rural area explained, "I often struggle to access the system because my internet connection is slow, which affects my ability to participate in online learning activities."

### 4.3. Statistical Analysis

The quantitative data from the surveys were analyzed to identify significant patterns and relationships between variables such as demographic factors (age, gender, discipline) and perceptions of EIS accessibility. Chi-square tests were applied to determine if there were significant differences between different groups.

#### 4.3.1. Differences in Perceptions Based on Demographics

The statistical analysis revealed that students from different disciplines had varying perceptions of the effectiveness of educational information systems. Students from technical disciplines (e.g., engineering and computer science) reported higher satisfaction and perceived accessibility of learning materials compared to students from non-technical disciplines (e.g., humanities and social sciences). This suggests that students with more technical backgrounds may be more comfortable navigating digital platforms, while those in non-technical fields may face more challenges.

Furthermore, gender differences were found, with female students reporting slightly higher satisfaction with EIS than male students. This difference, however, was not statistically significant, suggesting that while there may be variations in individual experiences, the overall impact of EIS on learning accessibility is generally positive across genders.

#### 4.3.2. Impact of EIS on Learning Accessibility

The study found that educational information systems have a substantial impact on improving learning accessibility in higher education. The systems provide flexible, on-demand access to course materials, support various learning styles, and enable personalized learning experiences. These features are particularly beneficial for students with diverse educational backgrounds and varying levels of digital literacy.

However, the study also identified several challenges, including technical issues, digital literacy gaps, and unequal access to infrastructure, which limit the full potential of these systems. To fully realize the benefits of EIS, it is essential to address these barriers by providing training for both students and faculty, ensuring equitable access to technology, and improving system reliability.

### 4.4. Conclusion

The findings indicate that educational information systems can significantly enhance learning accessibility in higher education by providing flexible access to learning resources, fostering engagement, and accommodating diverse learning needs. However, barriers such as digital literacy, infrastructure limitations, and technical difficulties need to be addressed to ensure that these systems can reach their full potential. Institutions must prioritize improving access to technology, providing adequate training, and ensuring the reliability of systems to enhance the overall learning experience for all students.

## 5. CONCLUSION

This research has explored the impact of educational information systems (EIS) on learning accessibility in higher education, focusing on how EIS can expand access to resources, facilitate communication, and

support diverse learning needs. The results show that the implementation of EIS significantly improves the accessibility of learning, particularly through facilitating access to flexible learning resources, providing real-time feedback, and providing more personalized learning pathways. Quantitative and qualitative data obtained from interviews and surveys with students and lecturers show that EIS can increase learning engagement and cater to different learning styles. The findings indicate that EIS plays an important role in creating a more inclusive and adaptive learning environment, providing substantial benefits to higher education institutions in their efforts to improve the quality of students' learning experience.

This research seeks to answer the question of how EIS affects accessibility in higher education and what are the barriers that might reduce its effectiveness. Based on the results of the analysis, it appears that while EIS provides many benefits in terms of accessibility, there are several obstacles that need to be considered, such as technical problems, digital literacy gaps, and data privacy issues. These barriers have the potential to reduce the effectiveness of EIS, especially in achieving the goal of equitable accessibility for all users. In addition, this study used largely self-reported data, which may have limitations such as participant response bias. Students in rural or underserved areas are likely to face challenges related to limited digital infrastructure, which may prevent them from fully accessing and utilizing EIS. The findings highlight the importance of addressing these barriers to maximize the benefits of EIS on learning accessibility and equity.

For future research, it is recommended to conduct a longitudinal study to evaluate the long-term impact of EIS implementation on academic outcomes and learning accessibility. Future research should also include more institutions with varying levels of technological advancement to gain a broader understanding of the effectiveness of EIS in various educational contexts. In addition, further exploration of ways to address the challenges identified, such as by providing training programs to improve digital literacy and strengthen data protection, will provide valuable insights for the development of EIS that are more inclusive and accessible to all students, including those with limited digital infrastructure. This follow-up research is expected to provide practical guidance for educational institutions in optimizing educational information systems to create a more inclusive, sustainable and equitable learning environment for all students.

## 6. DECLARATIONS

### 6.1. Author Contributions

Validation: RGM; Conceptualization: MA; Methodology: RF; Formal Analysis: MA; Writing Review and Editing: RGM; Visualization: NU; Each of the authors—RGM, MA, RF, NU— has reviewed and approved the manuscript's published form.

### 6.2. Data Availability Statement

The corresponding author may provide the data from this study upon request.

### 6.3. Funding

The research, writing, and/or publishing of this work were all done without financial assistance from the authors.

### 6.4. Institutional Review Board Statement

Not applicable.

### 6.5. Informed Consent Statement

Not applicable.

### 6.6. Declaration of Competing Interest

The authors state that none of their known conflicting financial interests or personal connections could have had an impact on the work that was published in this publication.

## REFERENCES

- [1] U. Rahardja, I. D. Hapsari, P. H. Putra, and A. N. Hidayanto, "Technological readiness and its impact on mobile payment usage: A case study of go-pay," *Cogent Engineering*, vol. 10, no. 1, p. 2171566, 2023.
- [2] U. Rahardja *et al.*, "Decision support system for ranking of students in learning management system (lms) activities using analytical hierarchy process (ahp) method," in *Journal of Physics: Conference Series*, vol. 1477, no. 2. IOP Publishing, 2020, p. 022022.

- [3] N. Lutfiani, N. P. L. Santoso, R. Ahsanitaqwm, U. Rahardja, and A. R. A. Zahra, "Ai-based strategies to improve resource efficiency in urban infrastructure," *International Transactions on Artificial Intelligence*, vol. 2, no. 2, pp. 121–127, 2024.
- [4] N. Lutfiani and L. Meria, "Utilization of big data in educational technology research," *International Transactions on Education Technology*, vol. 1, no. 1, pp. 73–83, 2022.
- [5] S. Purnama and C. Sriliasta, "Independent learning and blended learning information system student," *International Transactions on Education Technology*, vol. 1, no. 2, pp. 144–150, 2023.
- [6] P. Hendriyati, F. Agustin, U. Rahardja, and T. Ramadhan, "Management information systems on integrated student and lecturer data," *APTISI Transactions on Management*, vol. 6, no. 1, pp. 1–9, 2022.
- [7] U. Rahardja, I. Handayani, N. Lutfiani, and F. P. Oganda, "An interactive content media on information system ilearning+," *IJCCS (Indonesian Journal of Computing and Cybernetics Systems)*, vol. 14, no. 1, pp. 57–68, 2020.
- [8] A. Kristian, T. S. Goh, A. Ramadan, A. Erica, and S. V. Sihotang, "Application of ai in optimizing energy and resource management: Effectiveness of deep learning models," *International Transactions on Artificial Intelligence*, vol. 2, no. 2, pp. 99–105, 2024.
- [9] U. Rahardja, Q. Aini, D. Manongga, I. Sembiring, and I. D. Girinzio, "Implementation of tensor flow in air quality monitoring based on artificial intelligence," *International Journal of Artificial Intelligence Research*, vol. 6, no. 1, 2023.
- [10] S. W. F. binti Ambo'Miri, B. W. Kusuma, and A. N. Halimah, "Web-based information systems and knowledge management's impact on worker performance," *International Transactions on Education Technology*, vol. 2, no. 1, pp. 11–17, 2023.
- [11] I. Khong, "The circular economy's performance and the impact of digitalization," *International Transactions on Education Technology*, vol. 2, no. 1, pp. 18–23, 2023.
- [12] C. Lukita, M. Hardini, S. Pranata, D. Julianingsih, and N. P. L. Santoso, "Transformation of entrepreneurship and digital technology students in the era of revolution 4.0," *Aptisi Transactions on Technopreneurship (ATT)*, vol. 5, no. 3, pp. 291–304, 2023.
- [13] M. Ajeng, A. Kirei, and K. Amanda, "Blockchain technology application for information system security in education," *Blockchain Frontier Technology*, vol. 3, no. 1, pp. 26–31, 2023.
- [14] I. T. Sanusi, F. J. Agbo, O. A. Dada, A. A. Yunusa, K. D. Aruleba, G. Obaido, O. Olawumi, S. S. Oyelere *et al.*, "Stakeholders' insights on artificial intelligence education: Perspectives of teachers, students, and policymakers," *Computers and Education Open*, vol. 7, p. 100212, 2024.
- [15] W. Chen, S. M. Bohloul, Y. Ma, and L. Li, "A blockchain-based information management system for academic institutions: a case study of international students' workflow," *Information Discovery and Delivery*, vol. 50, no. 4, pp. 343–352, 2022.
- [16] E. P. Harahap, E. Sediyo, Z. A. Hasibuan, U. Rahardja, and I. N. Hikam, "Artificial intelligence in tourism environments: A systematic literature review," *2022 IEEE Creative Communication and Innovative Technology (ICCIT)*, pp. 1–7, 2022.
- [17] U. Rahardja, "ilearning an effective learning method for higher education," *Perguruan Tinggi Raharja*, 2011.
- [18] K. Patel, "An analysis of quality assurance for business intelligence process in education sector," *IJNRD-Int. J. Nov. Res. Dev*, vol. 9, no. 9, pp. a884–a896, 2024.
- [19] I. Y. Alyoussef, "Acceptance of e-learning in higher education: The role of task-technology fit with the information systems success model," *Heliyon*, vol. 9, no. 3, 2023.
- [20] O. Oladipupo and S. Samuel, "A learning analytics approach to modelling student-staff interaction from students' perception of engagement practices," *IEEE Access*, 2024.
- [21] A. K. Jackson, "Structured literacy professional learning and motivation in new mexico early childhood educators," Ph.D. dissertation, University of the Southwest, 2024.
- [22] T. Hussain, A. A. Khan, J. R. Pillai, and M. Al Siyabi, "Section i-studies on education," *Studies on Education, Science, and Technology 2023*, p. 4, 2023.
- [23] D. Mohammed, A. G. Prawiyog, and E. R. Dewi, "Environmental management/marketing research: Bibliographic analysis," *Startupreneur Business Digital (SABDA Journal)*, vol. 1, no. 2, pp. 191–197, 2022.
- [24] K. Jang and N. G. Landuyt, "Limited benefits of technological advances in human service organizations: Going beyond the hype using sociotechnical knowledge management system," *Journal of Social Service Research*, vol. 49, no. 4, pp. 426–446, 2023.

- [25] S. Baltazar, L. Barreto, A. Amaral, and T. Pereira, "Enterprise information systems (eis) as a key driver towards improved mobility," in *2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)*. IEEE, 2020, pp. 1–8.
- [26] T. Wahyuningsih, F. P. Oganda, M. Anggraeni *et al.*, "Design and implementation of digital education resources blockchain-based authentication system," *Blockchain Frontier Technology*, vol. 1, no. 01, pp. 74–86, 2021.
- [27] L. Chen, P. Chen, and Z. Lin, "Artificial intelligence in education: A review," *Ieee Access*, vol. 8, pp. 75 264–75 278, 2020.
- [28] D. Lynch, "Exploring a tailored approach for coordinated early intervening services (ceis) designed to address struggling general education students targeted for special education," 2024.
- [29] M. Moy and A. Feldstein, "Fostering digital communities: A case study of a university's digital master plan designed for networked learning among online learners," in *Networked Learning Conference*, vol. 14, 2024.
- [30] T. Ramayah, "Factors influencing the effectiveness of information system governance in higher education institutions (heis) through a partial least squares structural equation modeling (pls-sem) approach," *IAIC Transactions on Sustainable Digital Innovation (ITS DI)*, vol. 5, no. 2, pp. 100–107, 2024.
- [31] A. Bhutoria, "Personalized education and artificial intelligence in the united states, china, and india: A systematic review using a human-in-the-loop model," *Computers and Education: Artificial Intelligence*, vol. 3, p. 100068, 2022.
- [32] J. Ivković and V. Stanković, "Revolutionizing educational paradigms: Integrating precision-engineered ai into next-generation wearable technologies."
- [33] W. M. Beyene, A. T. Mekonnen, and G. A. Giannoumis, "Inclusion, access, and accessibility of educational resources in higher education institutions: exploring the ethiopian context," *International Journal of Inclusive Education*, vol. 27, no. 1, pp. 18–34, 2023.
- [34] A. Fernanda, M. Huda, and A. R. F. Geovanni, "Application of learning cloud computing technology (cloud computing) to students in higher education," *International Journal of Cyber and IT Service Management*, vol. 3, no. 1, pp. 32–39, 2023.
- [35] J. Seale, *E-learning and disability in higher education: accessibility research and practice*. Routledge, 2013.